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## SCIENTIFIC LETTER

# The applicability of the Framingham coronary heart disease prediction function to black and minority ethnic groups in the UK

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In the UK, coronary heart disease (CHD) morbidity and mortality is higher among the black and minority ethnic groups (BMEG).<sup>1</sup> A number of clinical tools are available to calculate an individual's absolute risk of developing CHD.<sup>2</sup> These are based upon data derived from the Framingham heart study (FHS), the participants of which were white, middle class Americans.<sup>3</sup> The prediction functions derived from the FHS data are multivariable mathematical weightings applied to major CHD risk factors to produce a probability estimate of developing CHD within a timeframe, and limitations are acknowledged when applying the Framingham data to other populations.<sup>4</sup>

Currently, data from UK cohort studies do not exist to test these functions among the BMEGs.

The aim of this study is to assess the applicability of the Framingham prediction function to BMEGs, by comparing the summary CHD risk scores between BMEG and whites, generated after application of the Framingham prediction function to individual cardiovascular risk factor data, and then to compare the relative summary risk scores with previously published measures of CHD mortality.<sup>1-5</sup>

## METHODS

Data on age, sex, self assessed ethnicity, smoking status, presence of ischaemic heart disease, diabetes, blood pressure, total cholesterol, and high density lipoprotein (HDL) cholesterol from the Health Surveys for England (HSE) 1998 and 1999 ([www.doh.gov.uk/public/hthsurep.htm](http://www.doh.gov.uk/public/hthsurep.htm)) were combined and analysed by SPSS v 10 and Microsoft Excel.

The HSE records the following ethnic groups: Irish, Caribbean, Indian, Pakistani, Bangladeshi, Chinese, and white. Diabetes was defined as doctor diagnosed diabetes diagnosed outside of pregnancy. Systolic and diastolic blood pressure measurements applied were the mean of the second and third readings of three. Adults aged 35-74 years were selected for this analysis. Individuals with previous CHD were excluded. A South Asian group was produced by amalgamation of Indian, Pakistani, and Bangladeshi groups to allow comparison with published data.

The Framingham prediction functions<sup>6</sup> were applied to the cross sectional data. This generated an absolute risk for each individual and these were logarithmically transformed. Medians by ethnic group were calculated on the original data. Means were calculated by ethnic group in five year age bands for the logarithmically transformed risk scores. These were then directly standardised to the mid 1998 standard population for England and Wales, to correct for differences in age structure between ethnic groups.

The logarithmic data allowed the calculation of crude and standardised mean risk ratios, with 95% confidence intervals,<sup>7</sup> for each ethnic group using the white population as the baseline.

## RESULTS

The combined data from the 1998 and 1999 surveys included 12 132 individuals aged 35-74 years without ischaemic heart disease, of whom 8406 (66%) had sufficient data to be included in this analysis. The principal reason for non-inclusion in the analysis was the non-consent for blood tests.

Table 1 shows the median 10 year risk scores, and ratio of mean 10 year risk scores with 95% confidence intervals by ethnic group. The standardised CHD mortality is presented for comparison.<sup>1-5</sup>

The ratio of standardised mean risk (SMR) scores compared to the white group vary by ethnic group. The rank ordering of CHD risk is generally the same as would be anticipated from the published mortality data, with some anomalies. For example, Irish women have a mean score ratio less than unity, but an SMR of 120. When South Asian women are considered, mortality decreases from Indian to Pakistani and to Bangladeshi; however, the ordering is reversed with respect to the ratio of the mean scores.

The magnitude of difference in risk between the ethnic groups is smaller than might be expected from the mortality data. For example, the SMR for CHD in South Asian men is 146, but the calculated ratio of mean risk is 116.

## DISCUSSION

This study assesses the applicability of the Framingham risk function among BMEGs utilising individual data from representative national surveys. The difference in age structure between ethnic groups has been addressed by the use of direct standardisation. It gives comparable estimate of risk by ethnicity as a study based on a south London population.<sup>8</sup>

The effectiveness of the Framingham prediction function should ideally be compared to incidence of CHD within a prospective cohort study. Mortality has been used as a proxy measure.

## Limitations

The cross sectional data is drawn from a different population from that of the mortality data. It reflects current cardiovascular risk whereas the mortality data reflect past cardiovascular risk, so that a cohort effect may be a partial explanation for the differences described.

Ethnicity is self referenced within the HSE, but classification for mortality is dependent upon country of birth.

A reduction in participation in the HSE from the interview stage to having blood taken showed variation between the

**Abbreviations:** BMEG, black and minority ethnic groups; CHD, coronary heart disease; FHS, Framingham heart study; HDL, high density lipoprotein; HSE, Health Surveys for England; SMR, standardised mean risk

**Table 1** Median risk scores, ratio of mean risk scores compared to whites (95% confidence intervals) and standardised mortality ratios (SMR) for coronary heart disease by ethnic group

	Ethnic group							
	Caribbean	Chinese	Irish	South Asian	Indian	Pakistani	Bangladeshi	White
<b>Men</b>								
Number in analysis	159	101	233	486	243	150	93	3008
Median risk score	9.08	6.83	8.68	8.17	7.71	6.96	11.65	9.30
Crude ratio of mean scores* ×100	92	78	96	94	88	85	130	100
Standardised ratio of mean risk scores* ×100 (95% CI)	91 (83 to 99)	85 (76 to 94)	101 (94 to 108)	116 (110 to 123)	107 (100 to 115)	113 (103 to 123)	144 (128 to 162)	100
SMR (95% CI) [20–74 years]†	62 (58 to 67)	44 (36 to 54)	124‡ (120 to 127)	146‡ (141 to 151)	142 (137 to 147)	148 (138 to 158)	151 (136 to 167)	100
<b>Women</b>								
Number in analysis	230	132	295	407	232	116	59	3355
Median risk score	2.21	2.17	3.47	2.42	2.31	2.18	3.55	3.81
Crude ratio of mean scores* ×100	64	65	84	76	73	73	95	100
Standardised ratio of mean risk scores* ×100 (95% CI)	94 (74 to 119)	72 (67 to 78)	97 (91 to 103)	117 (107 to 128)	109 (100 to 120)	115 (98 to 134)	121 (105 to 140)	100
SMR (95% CI) [20–74 years]†	86 (77 to 96)	43 (30 to 60)	120‡ (114 to 126)	151‡ (141 to 162)	158 (148 to 168)	111 (93 to 130)	91 (60 to 133)	10

\* Calculated using logarithmically transformed risk scores.

† References 1 and 5.

‡ 20–69 years.

ethnic groups and sex. This could have had an effect on the representativeness of the analysed group.

### Interpretation

In men, the ranking of ethnic group by standardised mean risk ratios is broadly the same as the ranking by mortality from CHD, though the size of the risk differences is smaller than the mortality differences. This is consistent with data that showed that in groups with low mortality the function overestimates, and in groups with high mortality it underestimates risk.<sup>9</sup> In women the risk ratio ranking reflects CHD mortality ranking less well.

The general pattern that the groups with higher mortality have higher estimated risk suggests that the prevalence of conventional cardiovascular risk factors, as measured in the FHS, may partially explain differences in CHD mortality between ethnic groups.

The impact of social class and deprivation<sup>10</sup> and greater susceptibility to established risk factors<sup>11</sup> may also be partial determinants of the differences.

Ideally, prospective validation of the risk functions should be performed and until a cohort study produces results, consideration should be given to whether an adjustment factor should be applied to the calculated risk scores when used in minority ethnic groups that experience an excess of CHD mortality compared to whites.

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